



## Abernathy Fish Technology Center Newsletter

Volume 9, Number 2, March/April 2017

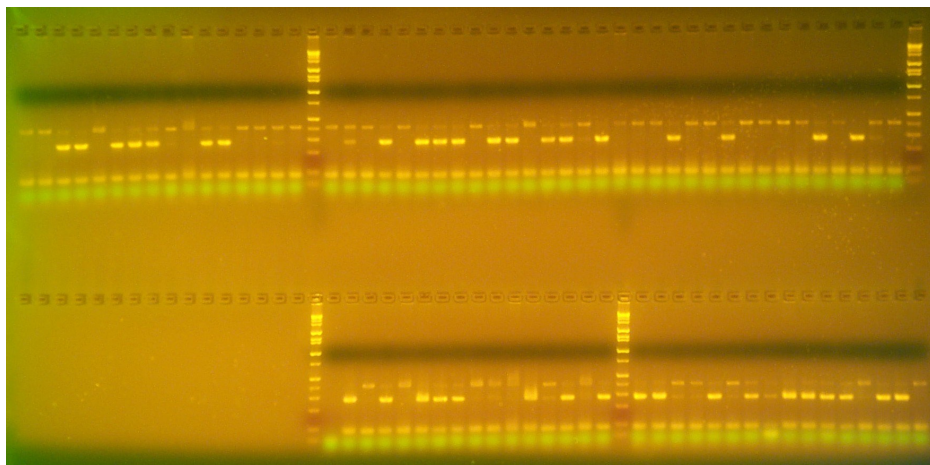
### In this issue:

Genetics Program	1-2
Staff	2
30 Years of Service	3
Program Highlights	3-5
Reports	4
Outreach	6-7
Meetings & Conferences	7-8
Ongoing Projects	9-10

### A Spotlight on the Genetics Program

*Providing information to facilitate execution of the FWS Mission.*

The services provided by Abernathy FTC are often described in terms of “Technical Capabilities.” Such descriptions may be useful to other FTCs and our Agency’s leadership, but might not always be effective for letting other FWS offices and partner offices know what we do. Our goal in this series is to describe, one technical program at a time, some of the services we provide for our partners. Here we describe the genetics program. Enjoy.



Genetic sex marker for Chinook salmon on an agarose gel. Each vertical lane represents either a size standard ("DNA ladder"), or the DNA from one Chinook salmon. Photo Credit: Jason Baumsteiger.

Genetics has become indispensable for the conservation of fish and wildlife, for it provides information and tools that can guide management. Our agency and partners routinely use genetic information in the decision-making process. Questions frequently posed to Abernathy FTC genetics staff include:

**“What species is this?” or “What population did this individual come from?”** These types of questions can be answered by comparing DNA from an individual in question to a database of reference samples. For example, we work with hydro-facility operators to determine origins of migratory bull trout captured at passage barriers. In some cases, additional information is requested by our partners, such as the sex of an individual organism or an individual’s parents based on genetic data.

**“What are the genetic risks or benefits of changing hatchery protocols?”** Early questions in this category mostly concerned culture practices which introduced artificial selection, such as selectively spawning the largest fish or the earliest-returning fish, or mixing the milt of several males prior to



## ***Spotlight on the Genetics Program (cont.)***

fertilization. Hatchery managers must make a large number of decisions about the spawning process which may impact genetic diversity, including numbers and ratios of males to females, spawning protocols, the rate at which different age classes (e.g., jacks) are incorporated, etc. By contributing our genetics expertise, we help hatchery managers understand the risks and benefits associated with various culture practices.

**“How divergent is this population?” or “Where are the boundaries between populations of this species?”** These types of questions are often asked in the context of listing, de-listing or development of recovery plans for Threatened or Endangered species. However, understanding population structure and divergence has relevance for informing management of any species. In order to preserve genetic diversity it is necessary to know how genetic resources are distributed across the species’ range. For example, managers often want to protect distinct populations, but it is important to determine whether such distinctions are based on recent processes such as bottlenecks or long-term isolation. Current genetic technology makes it possible to analyze samples collected from throughout a species’ range, or some sub-section of that range, and infer a population structure. By providing this information to managers, we aim to facilitate scientifically defensible decision making by our agency and our partners.

**“How genetically healthy is this population or species?”** One of our ultimate goals as an agency is to maintain viable populations of fish and wildlife that have a high likelihood of persisting into the future. A common request is to assess genetic diversity, which can aid management by identifying genetically robust populations or those in need of urgent management intervention. There is a suite of metrics that can be estimated with genetics and provide a valuable perspective for population monitoring, such as effective population size, effective number of breeders, relatedness, and inbreeding. We also use genetics to assess the occurrence of hybridization, whether between domesticated and wild populations (e.g., hatchery-origin fish stock versus wild stocks) or invasive and native species.

**“How can genetics help me?” or “What does this genetics study mean?”** As employees of the FWS, the most important function of genetics staff at Abernathy FTC is providing technical support for our regional and field offices. We are a resource for our offices and partners to provide expertise in the application and interpretation of genetic techniques and assist managers with interpreting the results of genetic studies conducted by external partners, such as those relevant for listing decisions.

## **Staff**

### ***Administration & Facilities***

Patty Crandell, Director  
Roger Root, Acting Deputy Director  
Steve Dyer, Administrative Officer  
Alina Nestjorkina, Administrative Assistant  
Mark Hack, IT Specialist  
Steve Money, Facility Operations Specialist  
Jeff Poole, Water Treatment Plant Operator  
Jim Lowell, Maintenance Worker

### ***Conservation Genetics***

Christian Smith, Regional Geneticist  
Justin Bohling, Conservation Geneticist  
Matt Smith, Conservation Geneticist  
Jennifer Von Bargaen, Lab Geneticist  
Brice Adams, Conservation Geneticist  
Matt Piteo, Biological Science Technician  
Ben Prom, Biological Science Technician

### ***Physiology & Nutrition***

Ann Gannam, Regional Nutritionist  
Richard Glenn, Microbiologist  
John Holmes, Fish Biologist  
Ron Twibell, Acting Regional Physiologist  
James Barron, Fish Biologist  
Kelli Hawke, Biological Science Technician  
Rachel Headley, SCA Intern

### ***Quantitative Ecology & Technology***

Doug Peterson, Senior Scientist  
Ben Kennedy, Fish Ecologist  
Will Simpson, Fish Biologist  
Kurt Steinke, Electronics Engineer  
Margot Cumming, SCA Intern  
Paul Kieras, SCA Intern



## 30 years of Service

John Holmes received his B.S. in Fisheries from University of Washington in 1979 and in December of 1984 he joined the service in a temporary position as a fisheries biologist with Abernathy FTC, which was then called Abernathy Salmon Culture Development Center. He later went into the private sector, but came back to Abernathy FTC in 1988 and eventually became a Fish Culturist, working with fall chinook until the mid-90s. He then returned to a position of Fish Biologist, which is his current title. In the 30 years that John contributed to FWS and more specifically Abernathy FTC, he has assisted on many projects. His favorite project was collaboration with the Columbia River Inter-Tribal Fish Commission to determine best practices for rearing white sturgeon to increase the population in the Columbia River. He assisted in capture of mature adult white sturgeon above McNary Dam; the team then transported the fish to Abernathy FTC where spawning was induced in captivity. The sturgeon eggs were incubated, and the fry were placed in raceways for early rearing and later released to the Columbia River. We would like to recognize his dedication to the FWS and his work in conservation.



*John Holmes with his 30-years of service award.  
Photo Credit: Alina Nestjorkina*

## Program Highlights

### Administration & Facilities

Roger Root, Deputy Field Supervisor of the Ventura FWO, began a detail as Deputy Director. He organized and moderated the Hatchery Management Training and will be at Abernathy FTC through mid-June.

Staff from the Cowlitz Indian Tribe, including wildlife biologist Eric White, met with Patty to begin a discussion about using Abernathy FTC's raceways to hold bearers for conservation purposes.

Patty turned in a justification/rationale to CO Maureen Kavanagh for continuing the Bonneville Power Administration (BPA) funded, Abernathy Creek steelhead project for three more years with a 50% reduction in funding in CY18 and a 75% reduction in CY19 and CY20. If the proposal is accepted, the final year of the project would be 2020.

Mary Mahaffy visited Abernathy FTC to present information about the North Pacific LCC and to plan the Science and Traditional Ecological Knowledge (S-TEK) subcommittee.

Mike Fields, Regional Chief Technology Officer for the Pacific and Pacific West Regions, visited with Aber-

nathy FTC administrative and IT staff to discuss our unique IT needs and new waivers for laboratory equipment.

Steve M. finished Abernathy FTC's annual safety audit and sent the paperwork to the RO.

Steve M. helped Spencer Berg conduct Heavy Equipment Training for the Pacific Region at Turnbull NWR and Dworshak NFH.

Jeff and Jim spent a week at Warm Springs NFH for a maintenance project. They planned, estimated, and performed the installation of a formalin drip system including installation of 200ft of conduit and pulled 200ft of 1/2 inch flexible tubing through the conduit starting from an existing HAZMAT building. They also connected tubing to a manifold system in an exterior metal cabinet to combine formalin and water for three holding areas and installed 200ft of PVC waterline and shut-off valves for each area.

Patty met with Kyle Hanson (Columbia River FWCO), Pat DeHaan (Western WA FWCO), and Denise Hawkins (Puget Sound Olympic Peninsula FAC Complex) to discuss sharing staff over the coming year to help with anticipated shortages.

# Program Highlights— continued

## Conservation Genetics

Rapid response season is once again in full swing in the genetics laboratory, and samples of bull trout and Chinook salmon have been arriving several days per week. When not processing these samples, laboratory staff have been working on prickly sculpin from the Nisqually River Basin, steelhead from the Deschutes River, steelhead from Abernathy Creek, and Alvord and Borax chub from eastern Oregon. Justin and Jennifer worked in the State of Washington genetics laboratory for two days last week, as part of an ongoing effort between Abernathy FTC and the State to share genetics expertise and laboratory equipment to address our mutual goals. They worked on genetic samples from Hood Canal coho salmon, and learned how to load a new type of genetic library (GTSeq) on an Illumina DNA sequencer.

Matt and Christian met with Oregon Department of Fish and Wildlife (ODFW) staff to discuss wrap-up of

our collaborative study of the impacts of hatchery fish on natural-origin steelhead in the Deschutes River. The final Abernathy FTC report on that project is expected to be completed this summer.

Brice wrote and shared two final reports with partners. The first describes genetic estimation of bull trout spawner abundance in the Lewis River, WA, and the second describes the genetic implications of bull trout passage efforts in Warm Springs Creek, MT.

## Physiology & Nutrition

The Fish Feed Quality Control Program received sixteen feed samples from the hatcheries in March and April. As part of the routine analyses, feeds from the hatcheries were checked for rancidity. Ann wrote the feed memos which are sent to the hatchery and the feed mill.

Ken Lujan from the Pacific Region Fish Health Program collected prerelease fish health samples. After the fish health assessment results came in, the steelhead smolts were released in April and May. Ken also met with Abernathy FTC staff to discuss possible cooperation concerning the Wild Fish Survey sampling and how the sampling could provide beneficial data for Abernathy FTC.

Richard and Ron collected the final gill samples from now released steelhead smolts that were reared at two Lower Snake River Compensation Plan (LSRCP) hatcheries, Ly-

ons Ferry (Washington Department of Fish and Wildlife (WDFW)) and Irrigon (ODFW). The gill samples will be analyzed to determine the saltwater readiness (smoltification) of the fish. This work is part of an ODFW-led project evaluating the effects of rearing conditions on steelhead smoltification and adult returns.

For the BPA project, John and Kelli spawned seven pairs of steelhead with six natural origin fish. The objective of this BPA-funded project is to examine differences between hatchery- and natural-origin fish.

Racheal, Student Conservation Association (SCA) intern, and Ron analyzed fatty acid profiles of 200 coho salmon eggs collected at Eagle Creek and Quilcene NFHs. The objective of the project is to examine the relationship between egg nutrient composition and reproductive success and to determine whether egg composition is influenced by ocean conditions. The information may increase our understanding of how changes in ocean conditions may affect future NFH production. In addition, Racheal analyzed the proximate composition of monthly fish samples from the Abernathy FTC steelhead project. The objective of this BPA-funded project is to examine differences between hatchery- and natural-origin fish. She also processed and analyzed the monthly steelhead samples from the Hagerman NFH Partial Reuse Aquaculture System (PRAS) project for proximate analysis. The objective of this portion of the project is to compare the body composition



Photo of a Prickly Sculpin captured in Cora Lake, WA.

Photo Credit: Roger Tabor (WWFWCO)

## Reports and Publications

Hanson, K. C. and J. M. Barron. 2017. Evaluation of the effects of marking Pacific lamprey *Entosphenus tridentatus* ammocoetes with visual implant elastomer, coded wire tags, and passive integrated transponders. Transactions of the American Fisheries Society. 146:4, 626-633.

Adams, B. and J. Doyle. 2017. Rapid response genetic analysis and genetic estimation of spawner abundance of bull trout collected in the Lewis River, WA. AFTC Final Report.

Adams, B., B. Prom, C. Smith, D. Brewer, and J. Lindstrom. 2017. Population assignment and hybrid status of bull trout passed above barriers in Warm Springs Creek, MT. AFTC Final Report.



## Program Highlights - continued

and seawater preparedness of steelhead reared in a PRAS system versus traditional raceways. Richard completed lab analysis of gill samples for several projects including the BPA steelhead and Hagerman NFH PRAS studies. Results of these analyses will be useful in assessing the seawater preparedness of the fish.

Ron assisted Kari Dammerman, Columbia River FWCO, in the collection of data and initial fish samples for a feed ration study starting at the Willard NFH. The goal of this project is to determine the influence of feeding level on precocial male maturation rates in upriver bright fall Chinook salmon.

The inventory of the Chelan PUD lamprey held at Abernathy FTC was completed. Growth data was collected and fish counts were done. Winter survival was good, around 95%. These lamprey are being held for the Chelan PUD studies which help determine culture methods for the lamprey ammocoetes. In addition, the second year annual report for this project was completed and submitted. Study planning and construction in the tank room are underway for year three of the project.

Lillian Smith, Christian's daughter, helped Racheal analyze proximate composition of steelhead whole bodies in the Nutrition Lab. The objective of this BPA - funded project is to examine differences between hatchery and natural - origin fish.

### Quantitative Ecology & Technology (QET)

QET staff had a busy month and a half preparing for field data collection in Abernathy Creek in support of the BPA-funded study on steelhead reproductive success. Ben K. and crew were challenged with inclement weather and high creek flows, but were able to re-configure and deploy three Passive Integrated Transponder (PIT) array systems in Abernathy Creek: two near Abernathy FTC and one near the confluence of Abernathy Creek and the Columbia River. These PIT systems monitor the timing and rate of seaward migration by hatchery and wild steelhead smolts, and can help detect whether hatchery steelhead remain in Abernathy Creek. Timing was critical, as the antennas had to be in place and operational before the wild steelhead smolts began to outmigrate and before hatchery steelhead from Abernathy FTC were released. They accomplished this task and the arrays are detecting movement not only by steelhead smolts, but also spawning migration by adult steelhead and outmigration by juvenile coho salmon. Data collected from the PIT arrays will allow staff to compare migration patterns of hatchery steelhead which were fed different diets; this is part of an ongoing study to determine how rearing practices in a conservation hatchery can affect survival and behavior of hatchery salmon.



*Three PIT tag antennas housed in heavy-duty PVC that detect PIT-tagged steelhead smolts as they are transferred from a hatchery raceway (at right) to a transport truck (at left) at Hagerman NFH. The antennas are connected to the PIT tag readers in the blue metal box at center. Photo Credit: Doug Peterson.*



*The fish enter the fish pump through the suction hose at bottom left, pass through a dewatering tower, and enter the transport truck through the PVC pipe at center. A rectangular PIT tag antenna is visible at bottom left, and three circular antennas are affixed to the PVC pipe at center. Photo Credit: Will Simpson*

Ben K. and SCA interns Margot and Paul are also working with WDFW to tag and monitor steelhead captured at the rotary screw trap located just upstream from the antenna array near the mouth of Abernathy Creek.

# Outreach

Patty was invited to give a presentation to the Lower Columbia Fly Fishers. She talked about the mission of the FWS and Abernathy FTC and the status of the BPA - funded Abernathy Creek steelhead project. The organization is very supportive of FWS and Abernathy FTC, and several members offered to volunteer as needed.

Fourteen Abernathy FTC staff assisted with a visit from STEM (science, technology, engineering and math) educators from throughout Southwest Washington funded through an nPower Girls grant. Patty welcomed the visitors then Steve D. led them to demonstrations of how we use computers in our work put on by Jennifer, Will, and James. Richard led a tour around the facility where John, Ann, Justin, Ron and SCA intern Margot discussed our projects and mission. Later, Jennifer, Ann, Brice, Ben K., and Alina contributed their personal stories during a panel discussion about careers in STEM fields.



*James Barron presenting the use of ImageJ program to the STEM teachers during their visit. Photo Credit: Alina Nestjorkina*

Sixteen students from the Fisheries Technology Program at Mount Hood Community College and faculty member Marla Chaney visited Abernathy FTC. Staff used the opportunity to demonstrate how a fisheries - oriented education might be utilized to conduct applied research.

Jennifer presented to approximately 100 4th and 5th graders at Harney Elementary School in Vancouver, WA. She discussed her path to becoming a geneticist and how we use genetics to answer conservation questions. This visit was arranged as a result of the STEM teachers' visit to Abernathy FTC earlier this year.

Ann reviewed a draft Fish Health Management Plan for Fish Health titled "Hatchery Template for the Development of Local Best Management Practices for Spawning to 1<sup>st</sup> Feeding of Pacific Salmon and Steelhead at Region 1 National Fish Hatcheries." She also reviewed the Warm Springs NFH Annual Operating Plan for the hatchery manager.

Richard provided assistance to Kestin Schultz and Holly Simon from Oregon Health and Science University (OHSU) for salmon gut sampling at Abernathy FTC and their metagenomic microbial baseline study/project. They also wanted to test protocols she will use to take fish intestine samples for a gut microflora study. An understanding of gut microflora in hatchery vs wild fish could be very important in understanding the ability of the fish to survive. Both feeds and antibiotics can alter the microflora.

Richard gave information to Ralph Lampman at the Yakama Nation Prosser hatchery about lamprey gut microbial analysis.

Ann was contacted by Northwest Indian Fish Commission fish health personnel about the nephrocalcinosis they were seeing in some broodstock at one of her hatcheries. Ann also had a request for information about the salt transfer diet and any studies done testing the feed and the efficacy of this product from a member of the Quinault Nation.



James participated in a lamprey outreach event at Franklin High School in Portland, OR. He spoke to the students about lamprey biology outreach helping them to become lamprey ambassadors. He worked with Sean Connolly from the Regional Office, Maureen Hosty, an Oregon State University (OSU) extension faculty member working in the area of 4-H youth development, Gabe Sheoships a Umatilla tribal member, and a member of Friends of Tryon Creek.

Ann and Christian attended the open house that Ron Wong held at Quilcene NFH for a group of veterinarians taking a continuing education course. Both delivered speeches on the use of science to inform hatchery management.

*Lamprey outreach at Franklin High School. Photo Credit: James Barron*





*Margot and Rachel presenting life stages of steelhead to the middle school class. Photo Credit: Alina Nestjorkina*

Kelli delivered an aquarium and eyed steelhead eggs to J.C. Thomas Middle School, Cathlamet, WA, for a Steelhead in the Classroom educational program. Kelli, James, Alina and SCA interns Racheal and Margot instructed the sixth grade class on the biology and life cycle of Pacific salmon. This presentation is part of the ongoing Salmon in the Classroom project that Kelli has been coordinating at the middle school.

Alina and Kelli attended Wahkiakum High School Career Day to represent FWS.

SCA interns Margot and Paul were busy with a number of outreach activities. They traveled to Spring Creek NFH to assist with Salmon in the Classroom visits from

Portland Area schools, and helped Jeff Johnson Columbia River FWCO with an outreach activity at the Woodlawn Elementary school in NE Portland. They also assisted staff at Conboy NWR with surveys for Oregon Spotted Frog.

Will spoke at Alki Middle School's career day in Vancouver, WA. He discussed his fun career as a biologist, how to acquire the necessary skills for a job in the field, and how to test drive a natural resource career through citizen science and volunteering.



*Margot Cumming and Paul Kieras at Conboy NWR during surveys for Oregon Spotted Frog. Photo Credit: FWS*

## ***Meetings, Conferences and Trainings***

- Ben K. is now Abernathy FTC's representative to the Pacific Lamprey Conservation Team, and has been participating in bi-weekly conference calls since mid April.
- Doug and Patty attended the jointly-held Hatchery Evaluation Team (HET) meeting for the Makah and Quinault NFHs, and presented a summary of the climate change vulnerability assessment for Makah. The Makah NFH manager intends to use this information for additional support for pursuing alternative salmon culture programs that do not involve summer rearing.
- James attended the Fisheries Academy at NCTC. At the Academy he made nationwide FWS contacts and learned interpersonal skills that can serve him well in his career.
- Richard attended the Oregon AFS meeting.
- James had a conference call with Sean Connolly in the RO and Dr. Benjamin Clemens, Fish Biologist and Statewide Lamprey coordinator for Oregon to discuss lamprey outreach using display tanks.
- Ron, James and Ann presented the nutrition portion of the Fish Nutrition/Fish Health Workshop in Lacey, WA at the Western Washington FWCO. Kelli attended the workshop as well as employees from Quinault, Quilcene and Makah NFHs, the Western Washington FWCO and the Quinault Indian Nation.
- Ann attended the Great Lakes Fish Health Committee meeting along with Wendy Sealey from the FWS Bozeman FTC as fish nutrition technical advisors. The committee consists of members from all of the states surrounding the Great Lakes as well as two Canadian provinces that border the lakes. The purpose for FWS attendance was to meet the committee and give presentations that illustrated our capabilities. This committee meeting was in conjunction with the American Fisheries Society Fish Health Section annual meeting and we were able to attend a few of the sessions that pertained to Great Lakes fish health issues.
- Almost all biological staff at Abernathy FTC attended at least one day of the Pacific Region's Science of the Service meeting. Ron gave a talk on steatitis titled, "Effects of dietary lipid source and ultraviolet radiation on growth, fatty acid profile and steatitis in steelhead, *Oncorhynchus mykiss*", Justin spoke about "Applying genomics to bull trout: biological insights and management applications", and Matt S. ended the SOS with a humorous summary, "Phylogenetics support an ancient common origin of two scientific icons: Devils Hole and Devils Hole Pup-fish". James displayed a poster on lamprey rearing titled "Effects of water flow rate on the culture performance of larval Pacific lamprey (*Entosphenus tridentatus*)".



- Ann, James, Richard, and Racheal attended one or both of the additional offerings in relation to the Science in the Service meeting, the tour of the Oregon Zoo Education Center to determine outreach opportunities and the workshop “Refining the Art of Communication, One of Our Best Hopes for Conservation”.
- Ann, Ron, Doug, Christian, all from Abernathy FTC and Kyle Hanson from the Columbia River FWCO attended the LSRCP annual meeting in Clarkston, WA. Christian was on a panel addressing the topic concerning selective spawning. Kyle Hanson spoke about Climate Change Vulnerability. Abernathy FTC provides assistance and support to the LSRCP facilities such as genetic consultations, fish feed quality control and technical assistance.
- Ann attended the Columbia Gorge Fisheries and Watershed Science Conference.
- Christian participated in FWS Conservation Genetics Community of Practice teleconferences. Topics included bio-informatics challenges faced by FWS laboratories, proposing a format for Genetic and Propagation Plans for Native Aquatic Species, and preparing an agenda for the upcoming FTC meeting.
- Steve D. attended Financial Assistance Training at the Portland Regional Office.
- Patty participated in the North Pacific LCC’s S-TEK group meeting to discuss Aquatic Connectivity.
- Patty participated in a conversation with FWS wildlife and fish health professionals and FAC staff from HQ about a National IACUC drafted by the NWRS.
- Abernathy FTC staff received training about asbestos/ lead and the electric weir.



*LSRCP meeting. (L to R), Doug Peterson, Christian Smith, Kyle Hanson and Ron Twibell. Photo Credit: Renee Heeren LSRCP*



*Fish release into the Abernathy Creek from the white pipe in the bottom right corner. Photo Credit: Alina Nestjorkina*



## Ongoing Projects

**Water velocity effects on salmon as reared in recirculating systems.** *Management Need:* Determine the effects of water velocity on composition, growth, condition, and performance of juvenile PNW salmon as applied to recirculating systems in support of hatcheries in the Pacific Region considering the use of recirculating systems. *Partners:* Pacific Region National Fish Hatcheries, Fishery Resources Program via Fisheries Operations and Need System (FONS).

**Diet development for Lost River and short nose suckers in the Klamath River Basin.** *Management Need:* Determine dietary needs of listed populations to assist in recovery. *Partners:* Klamath Tribes, Klamath Falls FWO, California/Nevada FHC.

**Development of diets and rearing techniques for the culture of Pacific lamprey, *Entosphenus tridentatus*.** *Management Need:* Assist Tribal partners in developing methods for the artificial propagation of Pacific lamprey, a species of concern. *Partners:* Yakama Nation; Fishery Resources Program via FONS.

**The physiological response of white sturgeon to handling stress in captivity.** *Management Need:* Determine if the stress from catch and release angling is detrimental to survival of white sturgeon, a species of concern. *Partners:* Dalhousie University; Carleton University.

**Pacific Region's Fish Feed Quality Control (FFQC) Program.** *Management Need:* The FFQC Program, the only one of its kind in the FWS, provides quarterly monitoring of the quality of the commercially produced fish feeds used at Pacific and Pacific Southwest Regions' NFHs. Information is compiled on an annual basis and used in the development of the Pacific Region fish feed contract. *Partners:* Pacific and Pacific Southwest Region's NFHs, Oregon, Washington, Idaho, and Tribal fish hatcheries.

**Effects of dietary lipid source and ultraviolet radiation on sunburn and steatitis in Steelhead, *Oncorhynchus mykiss*.** *Management Need:* Provide information regarding the potential relationship between fish nutrition and sunburn in steelhead. *Partners:* Pacific Region National Fish Hatcheries.

**Evaluation of thermal exposure of adult Chinook salmon during the migration to Warm Springs National Fish Hatchery.** *Management Need:* Determine if Chinook salmon migrating to Warm Springs National Fish Hatchery experience thermal stress. *Partners:* Warm Springs National Fish Hatchery, Lower Columbia Fish Health Center, Confederated Tribes of Warm Springs.

**Natural reproductive success and demographic effects of hatchery-origin steelhead in Abernathy Creek, WA.** *Management Need:* Provide information to help managers minimize differences between NOR and HOR fish. *Partners:* Bonneville Power Administration; Washington Department of Fish and Wildlife.

**Climate change vulnerability assessments of Pacific Region National Fish Hatcheries.** *Management Need:* An understanding of the anticipated habitat changes under different climate change scenarios provides managers with information to proactively respond to these conditions and their impact on NFHs. *Partners:* Pacific Region NFHs; Mid-Columbia River FRO; Fishery Resources Program via FONS.

**Fish suppression of common carp in Malheur Lake using electrofishing to target eggs and embryos.** *Management Need:* Determine the feasibility of using electrofishing to kill eggs and embryos for control of invasive common carp in Malheur Lake. *Partner:* Malheur NWR.

**Antenna design for the Biomark IS1001 PIT tag reader.** *Management Need:* Provide expert level engineering and technical assistance to partners monitoring species of interest using new technologies while reducing biologist time spent in design and troubleshooting. *Partners:* NOAA Fisheries, USFWS Green Bay.

**Entrainment and bypass of ESA-listed salmon at irrigation diversions on the Umatilla River.** *Management need:* Determine what environmental factors influence the magnitude of fish entrainment into irrigation canals and if captured fish are successfully screened and returned to the Umatilla River using PIT tag technology. *Partner:* Bureau of Reclamation.

**Aquatic organism passage (AOP) at remediated stream road crossings.** *Management Need:* Assess the efficacy of genetic, direct capture, and remote sensing methods to verify fish passage through remediated culverts. *Partners:* US Forest Service, Trout Unlimited.

**Mekong River fish ecology and sustainable development.** *Management Need:* Assess the scientific capacity and data needs for resource managers in Laos and Cambodia to address hydroelectric development on the main stem Mekong River. *Partners:* USGS, US DOI International Technical Assistance Program (ITAP).

**Effectiveness of transitioning to a locally-sourced steelhead broodstock at Winthrop National Fish Hatchery.** *Management Need:* Determine if hatchery improvement programs and actions are achieving the expected biological performance objectives. *Partners:* USFWS Mid-Columbia WW and NOAA Fisheries.

**Stress response of juvenile steelhead salmon to electrofishing and tagging under different thermal regimes.** *Management need:* To understand how fish respond to capture and handling under conditions experienced in late summer. *Partners:* USFWS Directorate Fellows Program.

## Ongoing Projects—continued

**Evaluation of the spatial and temporal distribution of juvenile Chinook Salmon in the Entiat River.** *Management Need:* Use genetic data to improve our understanding of the distribution of spring and summer run Chinook Salmon juveniles and thus improve our ability to prioritize restoration projects targeting spring Chinook Salmon recovery. *Partners:* USFWS Mid-Columbia FWCO.

**Design and installation of a PIT tag array to monitor outmigration of juvenile Pacific lamprey in the Umatilla River.** *Management need:* Determine entrainment rates of juvenile lamprey as they move downstream through the Umatilla River. *Partners:* NOAA-Fisheries, U.S. Bureau of Reclamation.

**Rapid response genetic analysis of threatened bull trout collected below dams in the Clark Fork River, MT.** *Management Need:* Provide data to inform upstream fish passage decisions for listed bull trout. *Partners:* Avista Corporation; Confederated Salish Kootenai Tribes; Idaho Fish and Game; Kalispel Tribe of Indians; Montana Fish Wildlife & Parks; Montana Ecological Services Field Office; Pend Oreille Public Utility District; Pennsylvania Power & Light, MT.

**Genetic identification of endangered winter-run Chinook salmon in the Sacramento River, CA.** *Management Need:* Rapid response broodstock identification for spawning of listed species. *Partners:* Livingston Stone NFH; Red Bluff FWO; NOAA Fisheries.

**Genetic analysis of bull trout in the Lewis River system.** *Management Need:* Facilitate passage of bull trout past hydroelectric facilities. *Partners:* Washington FWO, Columbia River FPO, PacifiCorp, U.S. Forest Service, Washington Department of Fish and Wildlife.

**Relative reproductive success of hatchery and wild steelhead in the Deschutes River basin.** *Management Need:* Develop genetic markers to monitor genetic diversity of listed populations. *Partners:* Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game, Columbia River Intertribal Fish Commission.

**Genetic needs assessment for endangered Lost River and short nose suckers of the Klamath River Basin, OR.** *Management Need:* Develop genetic markers to monitor genetic diversity of listed populations. *Partners:* Klamath Falls FWO, U.S. Geological Survey.

**Genetic profiles of broodstock at Pacific Region National Fish Hatcheries.** *Management Need:* Determine impacts of hatchery origin fish (HOR) on naturally occurring fish (NOR) and monitor the effects of aquaculture practices on HOR populations. *Partners:* Pacific Region NFHs, Fishery Resources Program via FONS.

**Genetic run assignment of juvenile Chinook salmon from the**

**American River.** *Management Need:* Assess accuracy of length-at-date method for distinguishing Spring run (ESA listed) from Fall run (unlisted) Chinook salmon smolts. *Partner:* Pacific Southwest Regional Office.

**Bull trout SNP marker discovery using RAD-seq.** *Management need:* Identify a standardized panel of SNP genetic markers that can be applied to population genetics studies across the species' range. *Partners:* Washington Department of Fish and Wildlife, Columbia River Inter-Tribal Fish Commission.

**Evaluating population structure and effective population size of redband trout in the Deschutes River, OR.** *Management need:* Genetic data will help identify management units for redband trout in the Deschutes River basin. *Partners:* Oregon Department of Fish and Wildlife.

**Genetic assessment of bull trout in the Upper Willamette River, OR.** *Management need:* Provides genetic information relevant to assessing the conservation status of the species and fish passage. *Partners:* Oregon Department of Fish and Wildlife.

**Use of Genetic Analysis to Determine Origins of Prickly Sculpin Populations in Nisqually River Basin.** *Management Need:* Evaluate the use of genetic tools to identify origin of an introduced population. *Partner:* Western Washington FWCO.

**Population structure of coastal cutthroat trout inhabiting urban watersheds in Portland, OR.** *Management Need:* Compare the characteristics of urban populations with their non-urban counterparts. *Partner:* Columbia River FWCO.

**Genetic profile of Hood Canal coho salmon populations using RAD sequencing.** *Management need:* Assess differentiation between wild coho salmon populations and the genetic impact of hatchery stocks. *Partners:* Northwest Watershed Institute, Quilcene National Fish Hatchery, Washington Department of Fish and Wildlife.

**Population genetic structure of Alvord Chub and relation to Borax Chub.** *Management need:* population structure information needed to inform listing decisions and recovery planning. *Partners:* USBLM, NDOW, ODFW, OSU.

**Rapid Response Genetic Analysis of Bull Trout Collected at Clear Creek Dam, WA.** *Management need:* population of origin information needed to facilitate fish passage. *Partners:* WDFW, Mid Columbia FWCO.

**Population structure and genetic stock identification of Icicle Creek Bull Trout.** *Management need:* we require information on the origins of Bull Trout impacted by the operation of Leavenworth NFH. *Partner:* Mid Columbia FWCO.

